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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	081862.P167
First Inventor or Application Identifier	Dean Cheng
Title	MANAGING NETWORK CONGESTION USING DYNAMICALLY
Express Mail Label No.	EL236840550US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

1. ☒ Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. ☒ Specification [*Total Pages* 22]
(preferred arrangement set forth below)
- Descriptive title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (*if filed*)
- Detailed Description
- Claim(s)
- Abstract of the Disclosure

3. ☒ Drawing(s) *(35 U.S.C. 113)* [*Total Sheets* 5]

4. Oath or Declaration [*Total Pages* 3]
a. ☒ Newly executed (original copy)
b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR §§ 1.63(d)(2) and 1.33(b).

5. ☐ Microfiche Computer Program *(Appendix)*

6. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
a. ☐ Computer Readable Copy
b. ☐ Paper Copy (identical to computer copy)
c. ☐ Statement verifying identity of above copies

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ACCOMPANYING APPLICATION PARTS

7. ☒ Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R. § 3.73(b) Statement ☐ Power of Attorney
(when there is an assignee)
9. ☐ English Translation Document *(if applicable)*
10. ☐ Information Disclosure Statement (IDS)/PTO - 1449 ☐ Copies of IDS Citations
11. ☐ Preliminary Amendment
12. ☐ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
13. ☐ *Small Entity Statement(s) ☐ Statement filed in prior application, Status still proper and desired
14. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
15. ☒ Other: California All-Purpose Acknowledgement - Notarized attachment to Assignment (2 pages)

16. If a **CONTINUING APPLICATION**, *check appropriate box, and supply the requisite information below and in a preliminary amendment:*
☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: _____

Prior application Information: Examiner _____ *Group/Art Unit:* _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

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Name	BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP				
Address	12400 Wilshire Boulevard, Seventh Floor				
City	Los Angeles	*State*	California	*Zip Code*	90025
Country	U.S.A.	*Telephone*	(714) 557-3800	*Fax*	(714) 557-3347

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Attorney Docket No. 081862.P167
Express Mail No.: EL236840550US

UNITED STATES PATENT APPLICATION

FOR

MANAGING NETWORK CONGESTION USING DYNAMICALLY ADVERTISED CONGESTION STATUS

INVENTORS:

Dean Cheng
Snehal Karia

PREPARED BY:

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP
12400 Wilshire Blvd., 7th Floor
Los Angeles, CA 90025-1026
(714) 557-3800

MANAGING NETWORK CONGESTION USING DYNAMICALLY ADVERTISED CONGESTION STATUS

Field of the Invention

This invention relates to computer networks. In particular, the invention relates to congestion management.

The Background of the Invention

Traffic congestion in a network causes many problems including disruption of services, delayed transmission, and system outage. The congestion may occur when a particular node in the network becomes saturated or overloaded with connections and service calls.

A network node may be come congested for a number of reasons. First, a flood of packets may transit through the node during some peak hours due to high demand, causing congestion. Second, the node may have resource problems such as memory capacity, bandwidth unavailability. Third, the node may undergo some maintenance mode switchover where resumption of calls would take longer that the stipulated outage time.

One technique to address the congestion problem is to drop or reject new call requests. This technique imposes a burden on the already congested node to execute a task to process the calls before rejecting them. Consequently, there are numerous crankbacks in the network, resulting in degraded performance and loss of revenue for the carrier. For service-oriented applications such as high availability applications, this congestion is undesirable.

SUMMARY OF THE INVENTION

A method and apparatus are described for managing congestion in a network. For a receiving node, a congestion status associated with a node in the network is determined. The congestion status is advertised to at least one other node in the network. For a sending node, a congestion status associated with a receiving node in the network is received. The congestion status corresponds to a measured node condition at the receiving node. A call is routed to the receiving node based on the received congestion status.

Other features and advantages of the invention will be apparent from the detailed description and drawings provided herein.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example and not limitation in the figures of the accompanying drawings in which like references indicated similar elements which:

Figure 1 shows a single peer system in which one embodiment of the invention can be practiced.

Figure 2 shows a hierarchical system in which one embodiment of the invention can be practiced.

Figure 3 shows a computer system for the congestion management.

Figure 4 shows a flowchart for a process to advertise the congestion status.

Figure 5 shows a flowchart for a process to respond to the advertised congestion status.

DETAILED DESCRIPTION

A method and apparatus are described for managing congestion in a network. For a receiving node, a congestion status associated with a node in the network is determined. The congestion status is advertised to at least one other node in the network. For a sending node, a congestion status associated with a receiving node in the network is received. The congestion status corresponds to a measured node condition at the receiving node. A call is routed to the receiving node based on the received congestion status.

The receiving node may be a transit node or a terminating node. The node may be a logical node which corresponds to a peer group of nodes in a hierarchical network. The call is routed to the node if the node is a terminating node or if the node is a transit node and the congestion status indicates that the node is not congested.

The advantages of the present invention include reducing network congestion, allowing the network to dynamically adapt to the changing conditions, reducing the outage of the call service, minimizing impact on users and support personnel, increasing revenue for the carrier, balancing traffic patterns, and eliminating traffic bottlenecks in the network.

In the following, the description refers to the Asynchronous Transfer Mode (ATM) model and the Peripheral Component Interconnect (PCI) bus as an interface example. It is contemplated that the technique is applicable to other models, buses, or network architectures with similar characteristics.

Figure 1 shows a single peer system 100 in which one embodiment of the invention can be practiced. The system 100 includes nodes N1 110, N2 120, N3 130, N4 140, N5 150, N6 160, N7 170, N8 180, customer premises equipment (CPE) 111, 112, 131, 132, 171, 172, 181, 182, and 183. The single peer system 100 represents a network in which nodes are interconnected at the same hierarchical

level and form a group. In one embodiment, the network is an ATM network having an interconnection model of the private network-to-network interface (PNNI).

Each of the nodes N1 110, N2 120, N3 130, N4 140, N5 150, N6 160, N7 170, and N8 180 is an ATM switch that performs switching and routing functions. A connection is made when a node requests a switched virtual circuit (SVC/ SPVC) call. Messages are sent and forwarded from one node to another via established connection links. For example, node N1 110 is connected to nodes N2 120 and CPE's 111 and 113; node N6 160 is connected to nodes N3 130, N5 150, and N7 170. Each of the nodes N1 110, N2 120, N3 130, N4 140, N5 150, N6 160, N7 170, and N8 180 is capable of measuring its own operational conditions such as traffic flow status, resource availability, maintenance status, etc. The measurement can be performed by any method suitable for the nodes. This is typically done locally at each ATM switch or network node. For example, the measurement can be performed using inter-switch network information or Service Specific Connection Oriented Protocol (SSCOP) L3 as specified in the ATM UNI 3.1 and 3.0. The measured conditions are used to indicate a congestion status which indicates whether or not a node has become congested. This congestion status can be broadcast or advertised to other nodes within the network. The broadcasting or advertising of the congestion status can be performed by setting a transit flag in the node. This transit flag is accessible to other nodes. In one embodiment, the transit flag is one of a topology state parameter in a PNNI system. The topology state parameter is part of a PNNI topology state element (PTSE) which is transmitted in a PNNI topology state packet (PTSP). The PTSE is routing information that is flooded in a peer group. The PTSP contains one PTSE. The topology state parameters include metrics and attributes. Examples of the metrics are maximum cell transfer delay (MCTD),

maximum cell delay variation (MCDV), maximum cell loss ratio (MCLR), and administrative weight. Examples of attributes are available cell rate (ACR), cell rate margin (CRM), variation factor (VF), branching flag, and restricted transit flag.

Each of the nodes N1 110, N2 120, N3 130, N4 140, N5 150, N6 160, N7 170, and N8 180 may be connected to a CPE such as a workstation, a computer system, or a peripheral device. As illustrated in Figure 1, node N1 is connected to CPE 111 and 112, node N3 130 is connected to CPE 131 and 132, node N7 is connected to CPE 171 and 172, and node N8 180 is connected to CPE 181, 182, and 183.

A node may be a transit node or a terminating node. A transit node is one through which a message is routed but is not a final destination. A terminating node is a destination node and is connected to at least one CPE. Each of the nodes has a congestion manager 105 to manage congestion at the node. The topology shown in Figure 1 is for illustrative purposes only. Other network topologies and/or configurations are possible. Each of the ATM switches or nodes N1 110, N2 120, N3 130, N4 140, N5 150, N6 160, N7 170, and N8 180 is configured to have a congestion manager 105.

Figure 2 shows a hierarchical system 200 in which one embodiment of the invention can be practiced. The hierarchical system 200 includes two hierarchical levels 201 and 202. The level 201 includes logical nodes A 210, B 220, and C 230. The level 202 includes nodes 211, 212, 213, 214, 221, 222, 223, 224, 225, 231, 232,and 233. The congestion management for the hierarchical system 200 is essentially similar to that of the peer group shown in Figure 1 except that the management is performed at the logical level.

Each of the logical nodes A 210, B 220, and C 230 corresponds to a peer group at the next lower level, i.e., level 202. The logical node A 210 corresponds

to a peer group including nodes 211, 212, 213, and 214. The logical node B 220 corresponds to a peer group including nodes 221, 222, 223, 224, and 225. The logical node C 230 corresponds to a peer group including nodes 231, 232, and 233. A logical node acts on the behalf of its child peer group. Each of the logical nodes A 210, B 220, and C 230 has a congestion manager 105 to manage congestion at the corresponding peer group.

In a hierarchical system, SVC/ SPVC connections can cross multiple peer groups. For example, a SVC/ SPVC connection may go from the logical node A 210 to the logical node C 230 passing through the logical node B 220. Each of the logical nodes represents its corresponding child peer group and manages the congestion of the peer group. For example, if the traffic condition at the peer group B 220 which includes nodes 221, 222, 223, 224, and 225, becomes congested, the parent logical node B220 advertises the congestion status to other logical nodes by setting its transit flag. The transit flag of each logical node is accessible to other logical nodes. In one embodiment, the transit flag is one of a topology state parameter in a PNNI system. The topology state parameter is part of a PNNI topology state element (PTSE) which is transmitted in a PNNI topology state packet (PTSP).

Other peer groups receive the congestion status of the logical node B 220 and avoid routing SVC/ SPVC calls traversing the peer group of the logical node B 220. The congestion at the peer group B 220 is therefore reduced.

Figure 3 shows a computer system 300 for the congestion management. The computer system 300 may be used as part of an ATM switch, a host machine, a workstation, a local area network (LAN), and any other system or subsystem connected to the network. The computer system 300 includes a processor 305, a host bus 310, a host bridge chipset 320, a system memory 330, a

peripheral bus 340, a mass storage device 350, a network interface device 355, and K peripheral devices 360_1 to 360_K.

The processor 305 represents a central processing unit of any type of architecture, such as complex instruction set computers (CISC), reduced instruction set computers (RISC), very long instruction word (VLIW), explicitly parallel instruction set computing (EPIC), or hybrid architecture. The invention could be implemented in a multi-processor or single processor computer system.

The host bridge chipset 320 includes a number of interface circuits to allow the host processor 305 access to the system memory 330 and the peripheral bus 340. The host bridge chipset 320 may include a memory controller, a bus interface circuit, and an I/O controller. The memory controller provides an interface to the system memory 330. The I/O controller provides control of I/O functions.

The system memory 330 represents one or more mechanisms for storing information. For example, the system memory 330 may include non-volatile or volatile memories. Examples of these memories include flash memory, read only memory (ROM), or random access memory (RAM). The system memory 330 contains a program 332, a data storage 334, and the congestion manager 105 as shown in Figure 1 and Figure 2. Of course, the system memory 330 preferably contains additional software (not shown), which is not necessary to understanding the invention.

The peripheral bus 360 provides bus interface to the mass storage device 350, the network interface 355, and the peripheral devices 360_1 to 360_K. In one embodiment, the peripheral bus 360 is the peripheral component interconnect (PCI) bus.

The mass storage device 350 include CD ROM, floppy diskettes, and hard drives. The mass storage device 350 stores non-volatile information such as

programs or data. The mass storage device 350 provides a mechanism to read machine-readable media. When implemented in software, the elements of the present invention are essentially the code segments to perform the necessary tasks. The program or code segments can be stored in a processor readable medium or transmitted by a computer data signal embodied in a carrier wave, or a signal modulated by a carrier, over a transmission medium. The "processor readable medium" may include any medium that can store or transfer information. Examples of the processor readable medium include an electronic circuit, a semiconductor memory device, a ROM, a flash memory, an erasable ROM (EROM), a floppy diskette, a compact disk CD-ROM, an optical disk, a hard disk, a fiber optic medium, a radio frequency (RF) link, etc. The computer data signal may include any signal that can propagate over a transmission medium such as electronic network channels, optical fibers, air, electromagnetic, RF links, etc. The code segments may be downloaded via computer networks such as the Internet, Intranet, etc.

The network interface device 355 provides an interface to a network such as ATM, LAN, WAN, etc. The peripheral devices 360_i to 360_K may include an audio device, a multimedia device, a modem, a printer controller, etc.

Figure 4 shows a flowchart for a process 400 to advertise the congestion status. The process 400 is used for a receiving node. The node may be a physical node or a logical node. A logical node acts on the behalf of its child peer group as described in Figure 2.

Upon START, the process 400 determines a congestion status at the node (Block 410). This determination can be performed by measuring a node condition. The node condition may include a traffic condition, resource availability such as memory or processor, and maintenance status. Then, the process 400 determines if the congestion status indicates a congestion at the node

(Block 420). If there is not congestion, the process 400 resets a "transit restricted" flag indicating that the node is not restricted for transit (Block 440). This transit flag is accessible to other nodes in the network. If there is a congestion, the process 400 sets a "transit-restricted" flag to indicate that all calls through the node should be avoided unless the node is a terminating node (Block 430).

Next, the process 400 advertises the congestion status by making the flag available for access to at least one other physical or logical node in the network (Block 450). Then, the process 400 is terminated.

Figure 5 shows a flowchart for a process 500 to respond to the advertised congestion status. The process 500 is used for a sending node. The node may be a physical node or a logical node. A logical node acts on the behalf of its child peer group as described in Figure 2.

Upon START, the process 500 receives a congestion status associated with a receiving node (Block 510). This congestion status corresponds to a measured node condition at the receiving node. Typically, the receiving of the congestion status is performed by accessing a transit flag of the receiving node. Then, the process 500 determines if the node is a termination node (Block 520). If the receiving node is a terminating node, the process 500 routes the SVC/ SPVC call to the node (Block 550). The process 500 is then terminated.

If the receiving node is not a terminating node, the process 500 determines if the congestion status indicates that there is a congestion at the node (Block 530). If there is no congestion, the process 500 goes to block 550. If there is a congestion, the process 500 routes the SVC/ SPVC call to another receiving node. Then the process 500 is terminated.

A technique has been described to manage congestion in a network. For a receiving node, a congestion status associated with a node in the network is determined. The congestion status is advertised to at least one other node in the

network. For a sending node, a congestion status associated with a receiving node in the network is received. The congestion status corresponds to a measured node condition at the receiving node. A call is routed to the receiving node based on the received congestion status.

In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the invention as set forth in the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

What is claimed is:

1. A method to manage congestion in a network, the method comprising:

determining a congestion status associated with a node in the network ; and

advertising the congestion status to at least one other node in the network.

2. The method of claim 1 wherein determining the congestion status comprises:

measuring a node condition at the node, the node condition corresponding to the congestion status.

3. The method of claim 1 wherein advertising the connection status comprises:

setting a transit flag, the transit flag being accessible to the at least one other node.

4. The method of claim 1 wherein the node is one of a transit node and a terminating node.

5. The method of claim 4 wherein the node is a logical node in a hierarchical network, the logical node corresponding to a peer group of nodes.

6. The method of claim 5 wherein the at least one other node is one other logical node in the hierarchical network, the one other logical node corresponding to one other peer group of nodes.

7. The method of claim 6 wherein the network is an asynchronous mode transfer (ATM) network.

8. The method of claim 7 wherein the node is one of a private network-to-network interface (PNNI) node.

9. The method of claim 8 wherein the transit flag is one of a PNNI topology state parameter.

10. A method to manage congestion in a network, the method comprising:
receiving a congestion status associated with a node in the network, the congestion status corresponding to a measured node condition at the node; and
routing a call to the node based on the received congestion status.

11. The method of claim 10 wherein receiving the congestion status comprises accessing a transit flag set by the node, the transit flag corresponding to the congestion status.

12. The method of claim 11 wherein the node is one of a transit node and a terminating node.

13. The method of claim 12 wherein the node is a logical node in a hierarchical network, the logical node corresponding to a peer group of nodes.

14. The method of claim 13 wherein routing the call to the node comprises:
routing the call to the node if the node is a terminating node; and

routing the call to the node if the node is a transit node and the congestion status indicates that the node is not congested.

15. The method of claim 11 wherein the network is an asynchronous mode transfer (ATM) network.

16. The method of claim 15 wherein the node is one of a private network-to-network interface (PNNI) node.

17. The method of claim 16 wherein the transit flag is one of a PNNI topology state parameter.

18. A computer program product comprising:

a computer usable medium having computer program code embodied therein for managing congestion in a network, the computer program product having:

computer readable program code for determining a congestion status associated with a node in the network ; and

computer readable program code for advertising the congestion status to at least one other node in the network.

19. The computer program product of claim 18 wherein the computer readable program code for determining the congestion status comprises:

computer readable program code for measuring a node condition at the node, the node condition corresponding to the congestion status.

20. The computer program product of claim 18 wherein the computer readable program code for advertising the connection status comprises:

computer readable program code for setting a transit flag, the transit flag being accessible to the at least one other node.

21. The computer program product of claim 18 wherein the node is one of a transit node and a terminating node.

22. The computer program product of claim 21 wherein the node is a logical node in a hierarchical network, the logical node corresponding to a peer group of nodes.

23. The computer program product of claim 22 wherein the at least one other node is one other logical node in the hierarchical network, the one other logical node corresponding to one other peer group of nodes.

24. The computer program product of claim 23 wherein the network is an asynchronous mode transfer (ATM) network.

25. The computer program product of claim 24 wherein the node is one of a private network-to-network interface (PNNI) node.

26. The computer program product of claim 25 wherein the transit flag is one of a PNNI topology state parameter.

27. A computer program product comprising:

a computer usable medium having computer program code embodied therein for managing congestion in a network, the computer program product having:

computer readable program code for receiving a congestion status associated with a node in the network, the congestion status corresponding to a measured node condition at the node; and

computer readable program code for routing a call to the node based on the received congestion status.

28. The computer program product of claim 27 wherein the computer readable program code for receiving the congestion status comprises computer readable program code for accessing a transit flag set by the node, the transit flag corresponding to the congestion status.

29. The computer program product of claim 28 wherein the node is one of a transit node and a terminating node.

30. The computer program product of claim 29 wherein the node is a logical node in a hierarchical network, the logical node corresponding to a peer group of nodes.

31. The computer program product of claim 30 wherein the computer readable program code for routing the call to the node comprises:

computer readable program code for routing the call to the node if the node is a terminating node; and

computer readable program code for routing the call to the node if the node is a transit node and the congestion status indicates that the node is not congested.

32. The computer program product of claim 28 wherein the network is an asynchronous mode transfer (ATM) network.

33. The computer program product of claim 32 wherein the node is one of a private network-to-network interface (PNNI) node.

34. The computer program product of claim 33 wherein the transit flag is one of a PNNI topology state parameter.

35. A system interfacing to a network comprising:

a processor coupled to the network; and

a memory coupled to the processor, the memory containing program code for managing congestion in the network, the program code when executed causing the processor to:

determine a congestion status associated with a node in the network, and

advertise the congestion status to at least one other node in the network.

36. The system of claim 35 wherein the program code causing the processor to determine the congestion status causes the processor to:

measure a node condition at the node, the node condition corresponding to the congestion status.

37. The system of claim 35 wherein the program code causing the processor to advertise the connection status causes the processor to:

set a transit flag, the transit flag being accessible to the at least one other node.

38. The system of claim 35 wherein the node is one of a transit node and a terminating node.

39. The system of claim 38 wherein the node is a logical node in a hierarchical network, the logical node corresponding to a peer group of nodes.

40. The system of claim 39 wherein the at least one other node is one other logical node in the hierarchical network, the one other logical node corresponding to one other peer group of nodes.

41. The system of claim 40 wherein the network is an asynchronous mode transfer (ATM) network.

42. The system of claim 41 wherein the node is one of a private network-to-network interface (PNNI) node.

43. The system of claim 42 wherein the transit flag is one of a PNNI topology state parameter.

44. A system interfacing to a network comprising:

a processor coupled to the network; and

a memory coupled to the processor, the memory containing program code for managing congestion in the network, the program code when executed causing the processor to:

receive a congestion status associated with a node in the network, the congestion status corresponding to a measured node condition at the node, and

route a call to the node based on the received congestion status.

45. The system of claim 44 wherein the program code causing the processor to receive the congestion status causes the processor to access a transit flag set by the node, the transit flag corresponding to the congestion status.

46. The system of claim 45 wherein the node is one of a transit node and a terminating node.

47. The system of claim 46 wherein the node is a logical node in a hierarchical network, the logical node corresponding to a peer group of nodes.

48. The system of claim 47 wherein the program code causing the processor to route the call to the node causes the processor to:

route the call to the node if the node is a terminating node; and

route the call to the node if the node is a transit node and the congestion status indicates that the node is not congested.

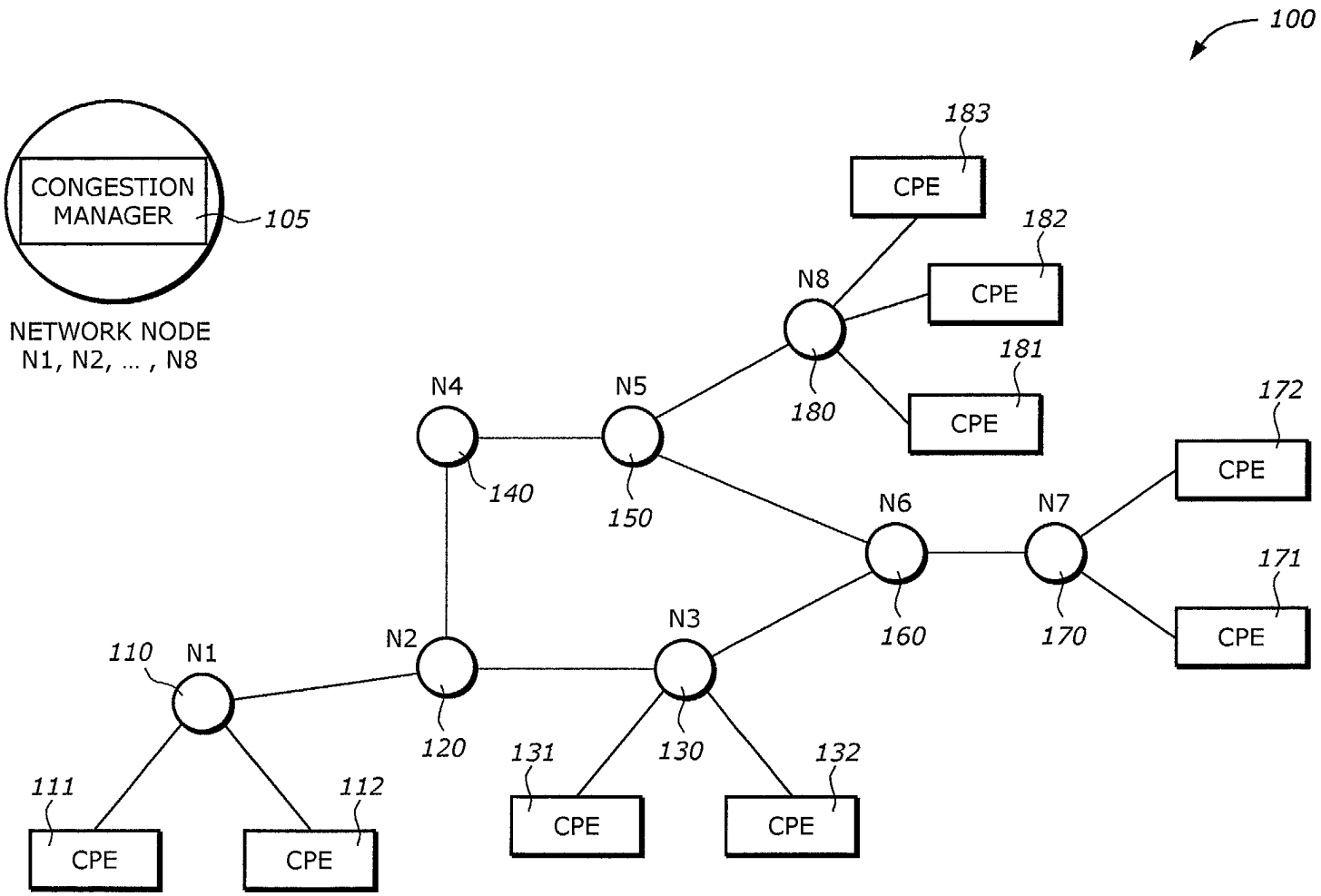
49. The system of claim 45 wherein the network is an asynchronous mode transfer (ATM) network.

50. The system of claim 49 wherein the node is one of a private network-to-network interface (PNNI) node.

51. The system of claim 50 wherein the transit flag is one of a PNNI topology state parameter.

ABSTRACT OF THE DISCLOSURE

A method and apparatus are described for managing congestion in a network. For a receiving node, a congestion status associated with a node in the network is determined. The congestion status is advertised to at least one other node in the network. For a sending node, a congestion status associated with a receiving node in the network is received. The congestion status corresponds to a measured node condition at the receiving node. A call is routed to the receiving node based on the received congestion status.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CPE
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CPE
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CPE
CPE
CPE
CPE
CPE
N1
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N3
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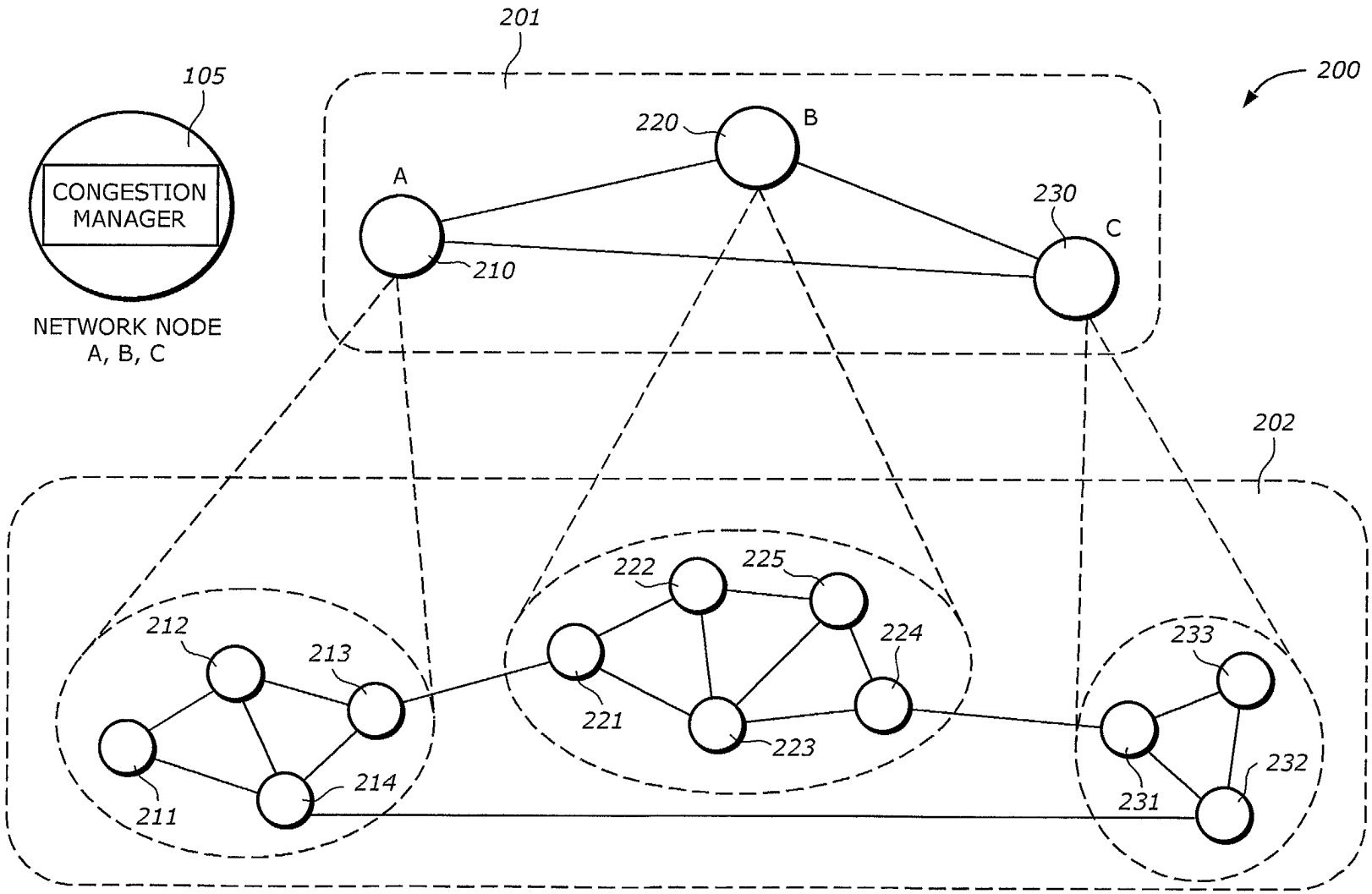
FIG. 1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CONGESTION MANAGER
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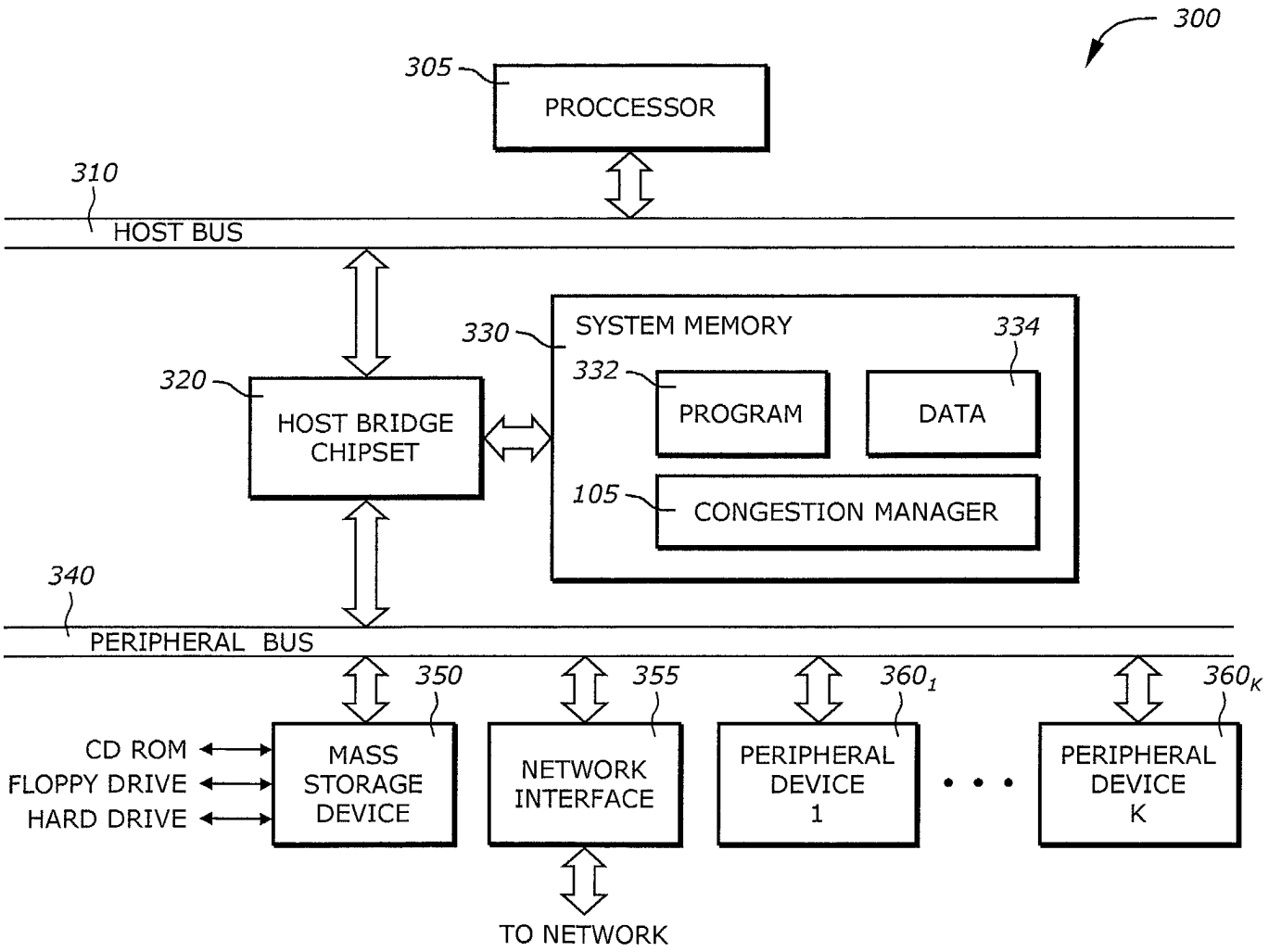
FIG. 2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HOST BRIDGE CHIPSET
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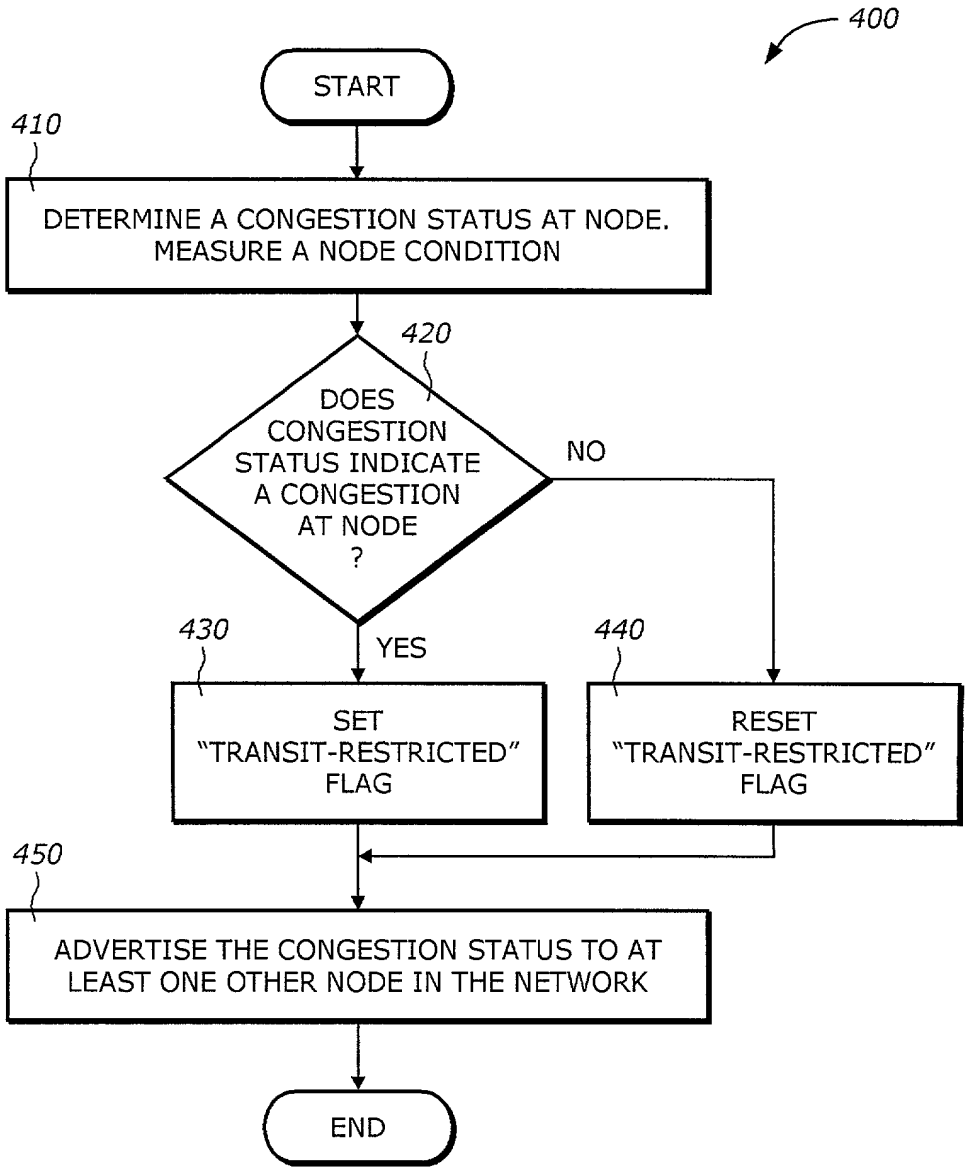
CONGESTION MANAGER
340
PERIPHERAL BUS
350
355
360$_1$
360$_K$
CD ROM
FLOPPY DRIVE
HARD DRIVE
MASS STORAGE DEVICE
NETWORK INTERFACE
PERIPHERAL DEVICE 1
PERIPHERAL DEVICE K
TO NETWORK

FIG. 3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DETERMINE A CONGESTION STATUS AT NODE. MEASURE A NODE CONDITION
420
DOES CONGESTION STATUS INDICATE A CONGESTION AT NODE ?
NO
YES
430
SET "TRANSIT-RESTRICTED" FLAG
440
RESET "TRANSIT-RESTRICTED" FLAG
450
ADVERTISE THE CONGESTION STATUS TO AT LEAST ONE OTHER NODE IN THE NETWORK
END

FIG. 4

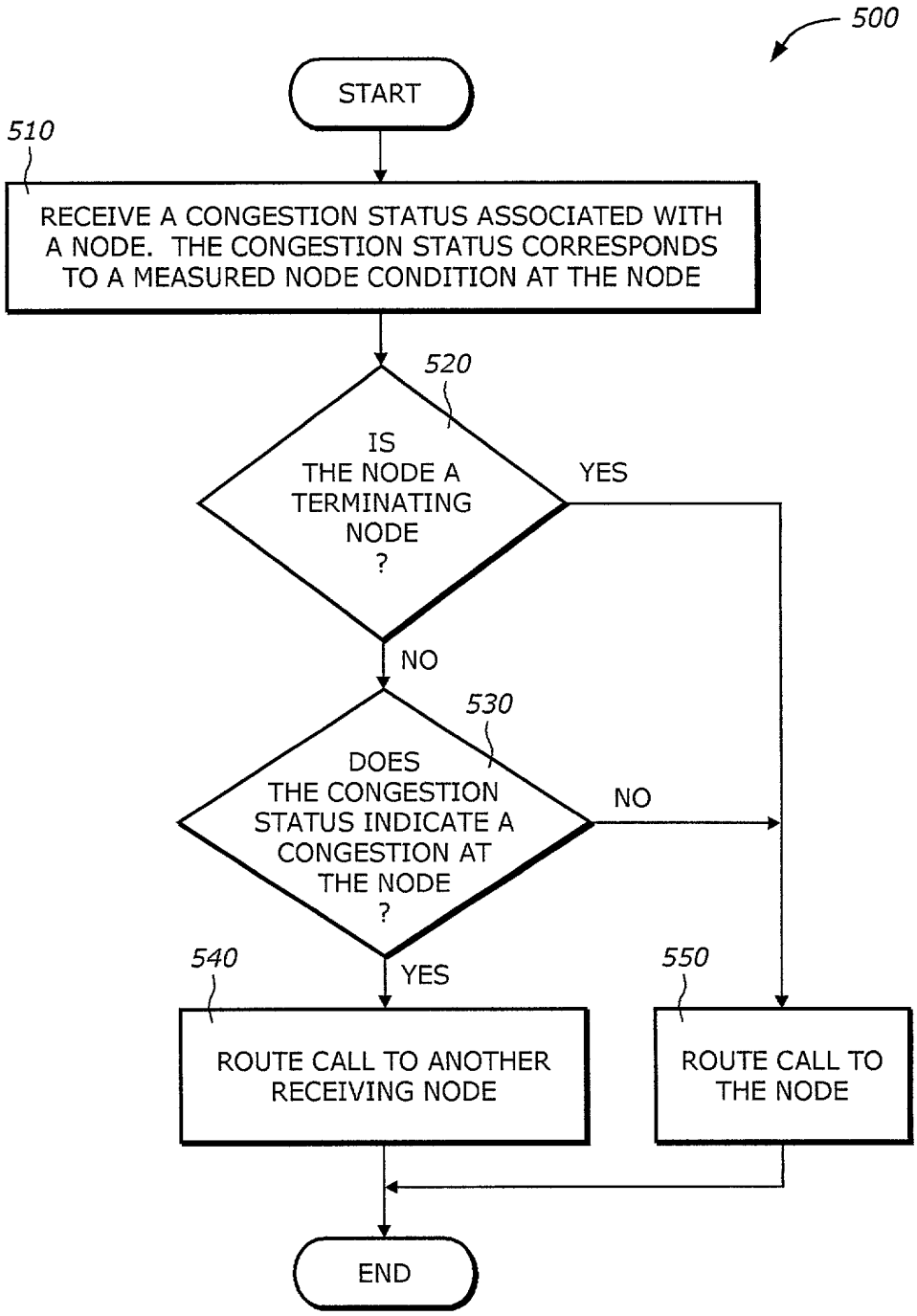
500
START
510
RECEIVE A CONGESTION STATUS ASSOCIATED WITH A NODE. THE CONGESTION STATUS CORRESPONDS TO A MEASURED NODE CONDITION AT THE NODE
520
IS THE NODE A TERMINATING NODE ?
YES
NO
530
DOES THE CONGESTION STATUS INDICATE A CONGESTION AT THE NODE ?
NO
YES
540
ROUTE CALL TO ANOTHER RECEIVING NODE
550
ROUTE CALL TO THE NODE
END

FIG. 5

Attorney's Docket No.: 081862.P167

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or any original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

MANAGING NETWORK CONGESTION USING DYNAMICALLY ADVERTISED CONGESTION STATUS

the specification of which
- [X] is attached hereto.
- [ ] was filed on _____ as
  United States Application Number _____
  or PCT International Application Number _____
  and was amended on _____
  (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

APPLICATION NUMBER	COUNTRY (OR INDICATE IF PCT)	DATE OF FILING (day, **month**, year)	PRIORITY CLAIMED UNDER 37 USC 119
			☐ No ☐ Yes
			☐ No ☐ Yes
			☐ No ☐ Yes

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION NUMBER	FILING DATE	STATUS (ISSUED, PENDING, ABANDONED)

I hereby appoint the persons listed on Appendix A hereto (which is incorporated by reference and a part of this document) as my respective patent attorneys and patent agents, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

Send correspondence to:
Thinh V. Nguyen, Reg. No. 42,034, BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, LLP
(Name of Attorney or Agent)
12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025 and direct telephone calls to:
Thinh V. Nguyen, (714) 557-3800.
(Name of Attorney or Agent)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole/First Inventor (given name, family name) **Dean Cheng**

Inventor's Signature Dean Cheng Date 1/14/2000

Residence Fremont, California USA Citizenship USA
(City , State) *(Country)*

P. O. Address 122 Mission Cielo Avenue
Fremont, California 94539 USA

Full Name of Second/Joint Inventor (given name, family name) **Snehal Karia**

Inventor's Signature Date 1/24/2000

Residence Fremont, California USA Citizenship India
(City , State) *(Country)*

P. O. Address 1026 Dolphin Common
Fremont, California 94536 USA

Appendix A

I hereby appoint BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, a firm including: William E. Alford, Reg. No. 37,764; Farzad E. Amini, Reg. No. 42,261; Amy M. Armstrong, Reg. No. 42,265; Aloysius T. C. AuYeung, Reg. No. 35,432; William Thomas Babbitt, Reg. No. 39,591; Carol F. Barry, Reg. No. 41,600; Jordan Michael Becker, Reg. No. 39,602; Bradley J. Bereznak, Reg. No. 33,474; Michael A. Bernadicou, Reg. No. 35,934; Roger W. Blakely, Jr., Reg. No. 25,831; Gregory D. Caldwell, Reg. No. 39,926; Ronald C. Card, Reg. No. 44,587; Thomas M. Coester, Reg. No. 39,637; Michael Anthony DeSanctis, Reg. No. 39,957; Daniel M. De Vos, Reg. No. 37,813; Robert Andrew Diehl, Reg. No. 40,992; Matthew C. Fagan, Reg. No. 37,542; Tarek N. Fahmi, Reg. No. 41,402; James Y. Go, Reg. No. 40,621; James A. Henry, Reg. No. 41,064; Willmore F. Holbrow III, Reg. No. 41,845; Sheryl Sue Holloway, Reg. No. 37,850; George W Hoover II, Reg. No. 32,992; Eric S. Hyman, Reg. No. 30,139; Dag H. Johansen, Reg. No. 36,172; William W. Kidd, Reg. No. 31,772; Eric T. King, Reg. No. 44,188; Erica W. Kuo, Reg. No. 42,775; Michael J. Mallie, Reg. No. 36,591; Paul A. Mendonsa, Reg. No. 42,879; Darren J. Milliken, Reg. No. 42,004; Chun M. Ng, Reg. No. 36878; Thien T. Nguyen, Reg. No. 43,835; Thinh V. Nguyen, Reg. No. 42,034; Dennis A. Nicholls, Reg. No. 42,036; Kimberley G. Nobles, Reg. No. 38,255; Lisa A. Norris, Reg. No. 44,976; Daniel E. Ovanezian, Reg. No. 41,236; Babak Redjaian, Reg. No. 42,096; William F. Ryann, Reg. No. 44,313; James H. Salter, Reg. No. 35,668; William W. Schaal, Reg. No. 39,018; James C. Scheller, Reg. No. 31,195; Jeffrey S. Smith, Reg. No. 39,377; Maria McCormack Sobrino, Reg. No. 31,639; Stanley W. Sokoloff, Reg. No. 25,128; Judith A. Szepesi, Reg. No. 39,393; Vincent P. Tassinari, Reg. No. 42,179; Edwin H. Taylor, Reg. No. 25,129; George G. C. Tseng, Reg. No. 41,355; Joseph A. Twarowski, Reg. No. 42,191; Lester J. Vincent, Reg. No. 31,460; Glenn E. Von Tersch, Reg. No. 41,364; John Patrick Ward, Reg. No. 40,216; Charles T. J. Weigell, Reg. No. 43,398; Kirk D. Williams, Reg. No. 42,229; James M. Wu, Reg. No. P45,241; Steven D. Yates, Reg. No. 42,242; Ben J. Yorks, Reg. No. 33,609; and Norman Zafman, Reg. No. 26,250; my attorneys; and Andrew C. Chen, Reg. No. 43,544; Justin M. Dillon, Reg. No. 42,486; Paramita Ghosh, Reg. No. 42,806; Sang Hui Kim, Reg. No. 40,450; and John F. Travis, Reg. No. 43,203; my patent agents, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (714) 557-3800, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.